

IN THE CLAIMS:

The text of all pending claims, (including withdrawn claims) is set forth below. Cancelled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~strikethrough~~. When ~~strikethrough~~ cannot easily be perceived, or when five or fewer characters are deleted, [[double brackets]] are used to show the deletion. The status of each claim is indicated with one of (original), (currently amended), (cancelled), (withdrawn), (new), (previously presented), or (not entered).

Please AMEND claims 2 and 6 and CANCEL claims 1, 7, and 11 as follows:

1. (CANCELLED)

2. (CURRENTLY AMENDED) An optical-electrical wiring board, comprising:
an electrical wiring board having a through-hole formed therein;
an optical wiring layer laminated on said electrical wiring board and including a core
through which the light is propagated and a clad surrounding said core; and
a mirror;
said electrical wiring board including an electrical wiring formed on a first surface and
mounting unit configured to mount an optical part and to be electrically connected to said
electric wiring and mounted in the vicinity of said through-hole of said first surface;
said core including a first waveguide to propagate the light in a first direction along said
electrical wiring board and a second waveguide to propagate the light in a second direction
perpendicular to said electrical wiring board, said second waveguide crossing the first
waveguide and a part of said second waveguide being arranged within said through-hole; and
[The optical-electrical wiring board according to claim 1, wherein said optical-electrical
wiring board further comprises a] said mirror arranged in the crossing point between said first
waveguide and said second waveguide and serving to reflect the light propagated through one
waveguide toward the other waveguide.

3. (ORIGINAL) The optical-electrical wiring board according to claim 2,
wherein one end of said second waveguide is exposed to said first surface.

4. (ORIGINAL) The optical-electrical wiring board according to claim 2, wherein said optical-electrical wiring board further comprises a light-collecting lens mounted on said first surface.

5. (ORIGINAL) The optical-electrical wiring board according to claim 2, wherein said second waveguide is tapered from said first surface toward a second surface opposite to said first surface or from said second surface toward said first surface.

6. (CURRENTLY AMENDED) The optical-electrical wiring board, comprising:
an electrical wiring board having a through-hole formed therein; [and]
an optical wiring layer laminated on said electrical wiring board;
and a mirror, [wherein]:
said electrical wiring board [includes] including an electrical wiring formed on the first surface [, and mounting means for mounting] and a mounting unit configured to mount an optical part, [said mounting means being] and to be electrically connected to said electrical wiring and arranged in the vicinity of said through-hole of said first surface [, and] ;
said optical wiring layer [includes] including a core [for propagating] to propagate the light in a direction extending along said electrical wiring board, and a clad surrounding said core [.] ; and
said mirror arranged in said core and configured to reflect the light propagoted through said core to the through-hole.

7. (CANCELLED)

8. (WITHDRAWN) (PREVIOUSLY PRESENTED) The optical-electrical wiring board according to claim 1, wherein said optical-electrical wiring board further comprises mounting means for mounting an electrical part arranged on said first surface, said mounting means being electrically connected to said electrical wiring.

9. (WITHDRAWN) (PREVIOUSLY PRESENTED) The optical-electrical wiring board according to claim 2, wherein:
said electrical wiring comprises a plurality of layers, and

connecting means for electrically connecting said plural layers of said electrical wiring is arranged inside said through-hole.

10. (WITHDRAWN) (PREVIOUSLY PRESENTED) The optical-electrical wiring board according to claim 2, wherein said mounting means is arranged such that, when a light-emitting element or a light-receiving element is mounted on said mounting means, the light-emitting surface of said light-emitting element or the light-receiving surface of said light-receiving element is arranged on the axis of said second waveguide.

11. (CANCELLED)

12. (PREVIOUSLY PRESENTED) A mounted board prepared by mounting an electric part to the optical-electrical wiring board according to claim 2.

13. (WITHDRAWN) (ORIGINAL) A method of manufacturing an optical electrical wiring board, comprising:
the step of forming a through-hole in an electrical wiring board having an electrical wiring formed on a first surface;
the step of bonding an optical wiring layer including a core and a clad surrounding said core to a second surface opposite said first surface of the electrical wiring board; and
the step of forming a mirror in said optical wiring layer, said mirror serving to reflect the light propagated through said core toward said through-hole
or to reflect the light passing through said through-hole so as to be incident on said mirror toward said core.

14. (WITHDRAWN) (ORIGINAL) A method of manufacturing an optical-electrical wiring board, comprising:
the step of forming a first through-hole in an electrical wiring board having an electrical wiring formed on a first surface;
the step of filling said first through-hole with a clad;
the step of bonding an optical wiring layer including a first core and a clad surrounding said first core to a second surface opposite said first surface of said electrical wiring board;
the step of forming a second through-hole having an inner diameter smaller than the

inner diameter of said first through-hole and extending through said electrical wiring board, said first core, and said clad surrounding said first core in a central portion of said first through-hole;

the step of filling said second through-hole with a second core so as to form a waveguide extending in a direction perpendicular to said electrical wiring board; and

the step of forming a mirror reflecting the light propagated through one core toward the other core in a portion where said first core and said second core are allowed to cross each other.

15. (WITHDRAWN) (ORIGINAL) A method of manufacturing an optical-electrical wiring board, comprising:

the step of forming a first through-hole in an electrical wiring board having an electrical wiring formed on a first surface;

the step of filling said first through-hole with a clad;

the step of forming an optical wiring layer including a first core and a clad surrounding said

first core on a second surface opposite to said first surface of the electrical wiring board;

the step of forming a second through-hole having an inner diameter smaller than the inner diameter of said first through-hole and extending through said electrical wiring board, said first core and said first clad surrounding said first core in a central portion of said first through-hole;

the step of filling said second through-hole with a second core so as to form a waveguide extending in a direction perpendicular to said electrical wiring board; and

the step of forming a mirror reflecting the light propagated through one core toward the other core in a portion where said first core and said second core are allowed to cross each other.

16. (WITHDRAWN) (PREVIOUSLY PRESENTED) The method of manufacturing an optical-electrical wiring board according to claim 14, wherein said method further comprises the step of forming a light-collecting lens in one edge of said second core on the side of said first surface.

REMARKS

INTRODUCTION

The Applicants request reconsideration and allowance of the present application in view of the foregoing amendments and the following remarks.

Claims 2-6, 8-10, and 12-16 are pending in the present application. Claims 8-10 and 13-16 are withdrawn from consideration. Claims 2 and 6 are the independent claims.

Corrected FIGS. 1-5, 8C, and 9-13 have been attached to correct apparent drafting errors as would be understood by one of ordinary skill in the art based on the totality of the disclosure.

Initially, the Applicants note that claims 2-5 were indicated as containing patentable subject matter and would be allowed if rewritten in independent form to include all the limitations of their base claims and any intervening claims.

Claims 1, 6, 11, and 12 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Taguchi et al. (JP 09-281,352).

Claim 7 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Taguchi et al. (JP 09-281,352) in view of Mehlhorn et al. (U.S. Patent 6,285,808).

No new matter is being presented, and approval and entry of the foregoing amendments is respectfully requested.

ALLOWABLE SUBJECT MATTER

In the Office Action, at page 4, numbered paragraph 6, claims 2-5 were objected to as being dependent upon a rejected base claim, but were indicated as being allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The Applicants respectfully submit that amended claim 2 has been rewritten in independent form including all of the limitations of cancelled base claim 1. Thus, the Applicants respectfully submit that amended independent claim 2 and depending claims 3-5 are in condition for allowance, and submit that the objection is deemed moot.

REJECTION UNDER 35 U.S.C. §102:

In the Office Action, at page 2, numbered paragraph 3, claims 1, 6, 11, and 12 were rejected under 35 U.S.C. §102 in view of Taguchi et al. (JP 09-281,352). This rejection is

traversed and reconsideration is requested.

As a point of clarification, claims 1 and 11 have been cancelled without prejudice or disclaimer. As such, it is respectfully submitted that the rejection of claims 1 and 11 is deemed moot.

As a further point of clarification, the Applicants note that claim 12 depends on amended independent claim 2, which has been indicated to contain allowable subject matter. Therefore, the Applicants respectfully submit that the claim 12 is deemed patentable at least due to its depending on amended claim 2, and that rejection of claim 12 is deemed moot.

Additionally, claim 6 has been amended to include a “mirror arranged in said core and configured to reflect the light propagated through said core to the through-hole.” As noted in page 4, numbered paragraph 5, of the Office Action, discussing rejected claim 7, Taguchi et al. does not disclose the use of a mirror for reflecting the light propagated through said core. The Applicants submit that the additional element of a mirror in claim 6 renders the rejection under 35 U.S.C. §102 in view of Taguchi et al. moot.

However, the Applicants further submit that a rejection under 35 U.S.C. §103(a) as being unpatentable over Taguchi et al. in view of Mehlhorn et al. similar to that of cancelled claim 7 would be improper for the following reasons.

Initially, the Applicants note that the invention of claim 6 differs from the citation Mehlhorn et al. in both the structure of the mirror reflecting the light propagated through the core, and the structure of the propagation path of the mirror and the optical part.

Specifically, amended claim 6 has as an element, a “mirror arranged in said core.” The citation of Mehlhorn et al. does not disclose or suggest such a structure. Rather, Mehlhorn et al. discloses a method reflecting light after it has left an optical layer. The optical deflecting system of Mehlhorn et al. is not arranged in the core, it is separate from the optical layer as shown by the use of a “fiber optic waveguide stub” (Mehlhorn et al., col. 3, lines 50-61).

While the Applicants note that Mehlhorn et al. states, “[t]he optical waveguide stub 7 is not absolutely essential” (Mehlhorn et al., Col. 4, lines 18-19), the Applicants respectfully submit that Mehlhorn et al. does not teach or enable any method or device that would operate without the stub. As such, Mehlhorn et al. does not describe or suggest arranging a mirror in the core.

Specifically, the mirror of claim 6 reflects the light propagated through the core, the light reflected by the mirror passes through a through-hole and enters the optical part mounted on

the optical-electrical wiring board. Whereas the circuit carrier of Mehlhorn et al. discloses a method of optically connecting an optical wiring 1 and an optical part by sandwiching an optical wiring 1 with two electrical wirings 2 and 3, and the mirror reflecting the light by inserting an optical waveguide stub formed in a determined angle into an optical path. Therefore, there is no structure of having a mirror formed in the core as in the present invention.

Furthermore, the Applicants submit that a rejection under 35 U.S.C. §103(a) as being unpatentable over Taguchi et al. in view of Mehlhorn et al. similar to that of cancelled claim 7 would be improper due in part to a non-evident advantage of the present invention.

As a result of the structure of the present invention as recited in claim 6, it is possible to easily adjust the reflection angle of the light to compensate for the effects that lamination may have on the light propagation and the state of the optical connection. The compensation is easily performed by forming the mirror in the core after the lamination process.

On the other hand, in the method of Mehlhorn et al., it is difficult to adjust the reflection angle of the light, in terms of industrial technique, because the angle is adjusted by the position in which the optical waveguide stub is inserted. If the insertion of the optical waveguide stub is inaccurate, the optical connection between the optical wiring and the optical part cannot be accomplished. In Mehlhorn et al., the reflection angle of the light and the state of the optical connection are determined by the accuracy of the positioning of both the core, and the hole in which the optical waveguide stub is inserted. The accuracy of the position of laminating a waveguide on the circuit board and the position of insertion are critical to the success of Mehlhorn et al.. Therefore, it is not possible, using the apparatus disclosed in Mehlhorn et al., to compensate for the effects on light propagation resulting from the lamination of the electrical wiring onto the optical wiring. And as such, the present invention as recited in claim 6 provides the non-evident advantage of easy correction of the reflecting angle that is not found in Mehlhorn et al.

REJECTION UNDER 35 U.S.C. §103:

In the Office Action, at page 4, numbered paragraph 5, claim 7 was rejected under 35 U.S.C. §103(a) as being unpatentable over Taguchi et al. (JP 09-281,352) in view of Mehlhorn et al. (U.S. Patent 6,285,808). The reasons for the rejection are set forth in the Office Action and therefore not repeated.

As a point of clarification, claim 7 has been cancelled without prejudice or disclaimer.

As such, it is respectfully submitted that the rejection of claim 7 is deemed moot.

CONCLUSION

In accordance with the foregoing, the specification, drawings, and claims 2 and 6 have been amended. Claims 1, 7, and 11 have been cancelled. Claims 2-6, 8-10, and 12-16 are pending and under consideration. Claims 8-10 and 13-16 are withdrawn from consideration. However, with allowance of amended independent claim 2, previously withdrawn claims 9 and 10, dependent on claim 2, should now be considered and allowed as well.

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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FIG. 1

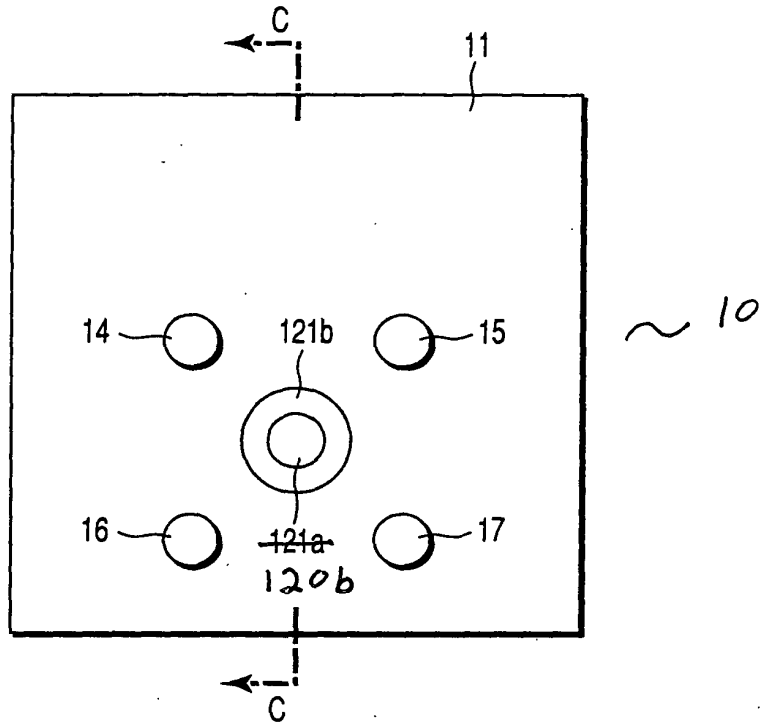
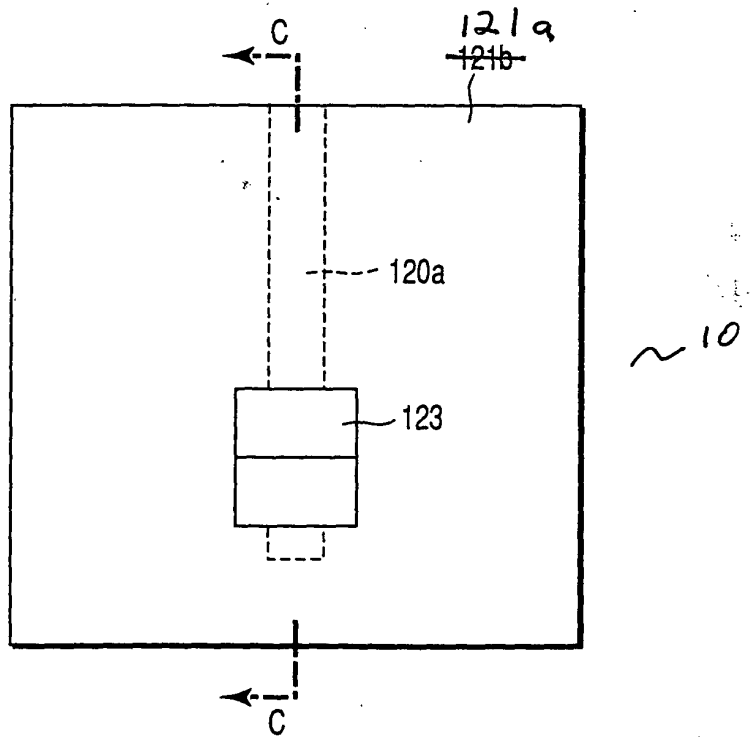


FIG. 2





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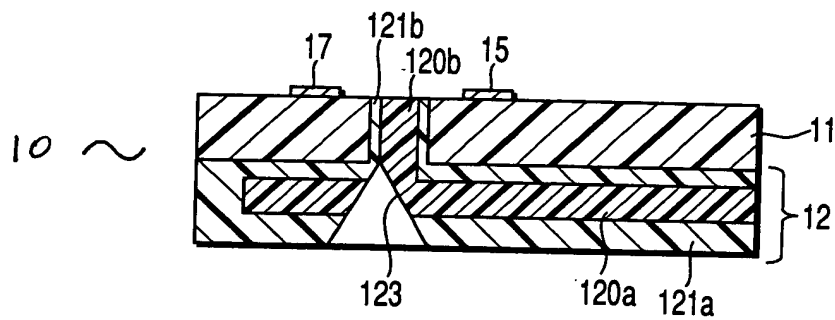


FIG. 3

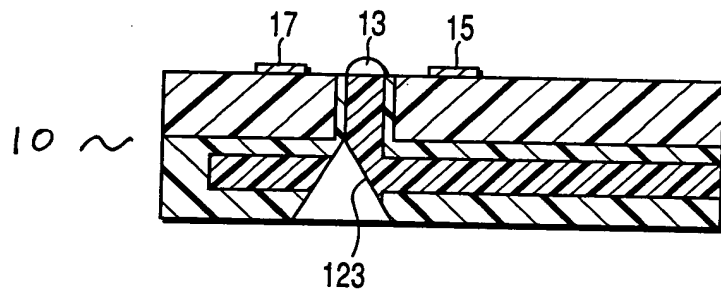


FIG. 4

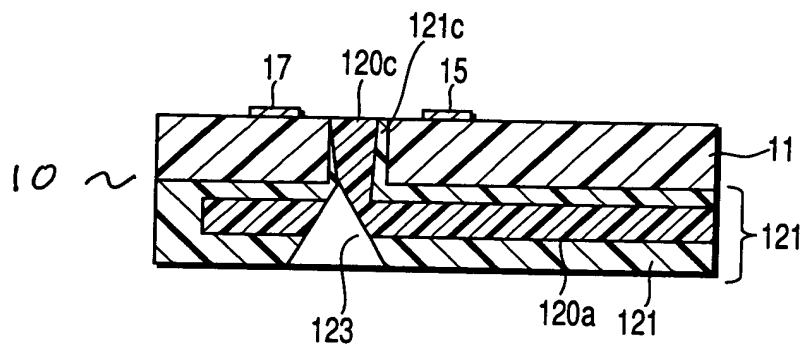


FIG. 5

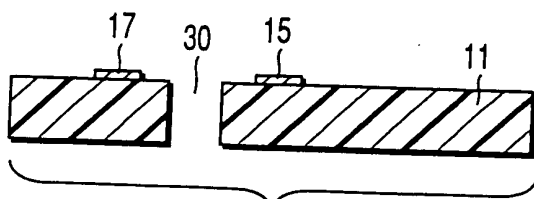


FIG. 8A

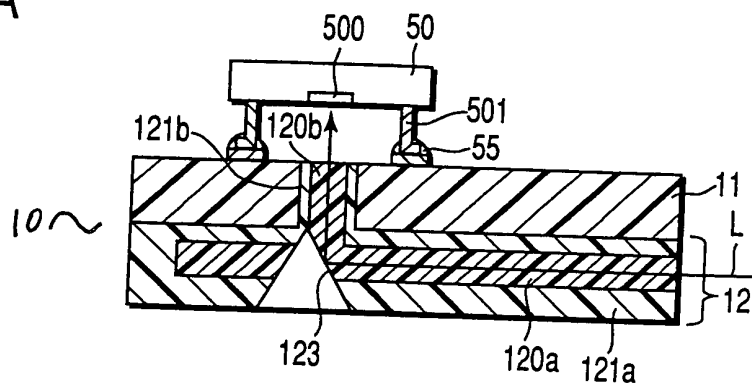


FIG. 9

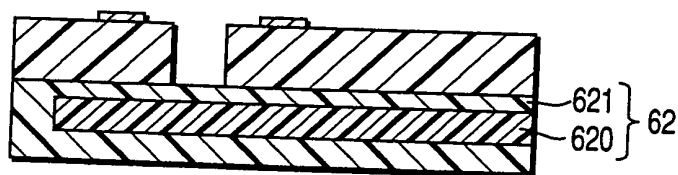


FIG. 8B

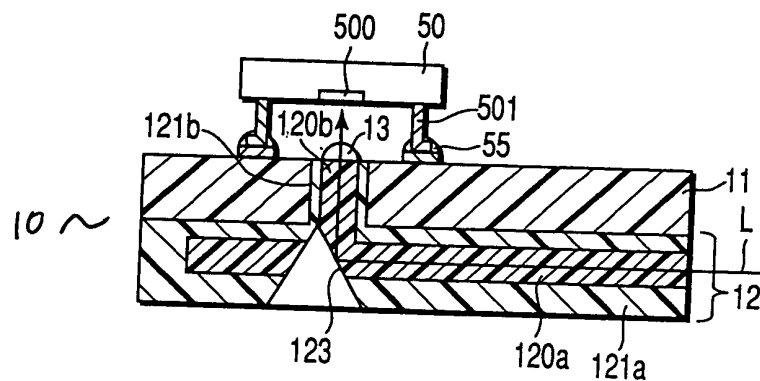


FIG. 10

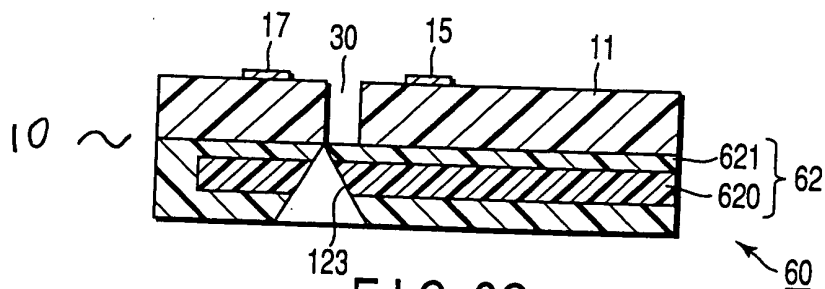


FIG. 8C

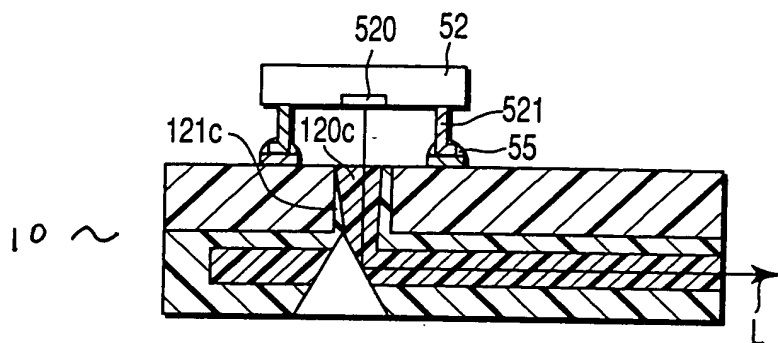


FIG. 11

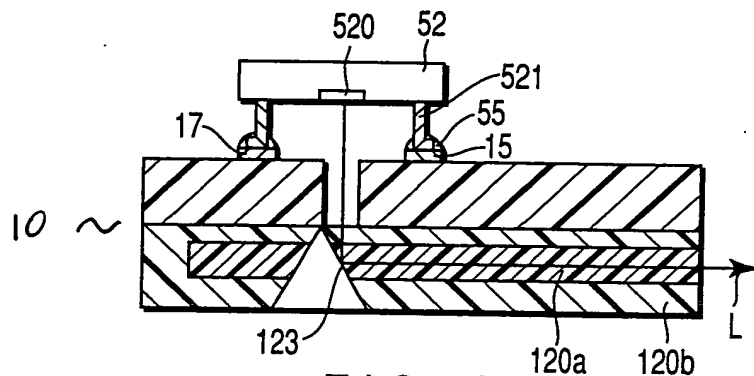


FIG. 12

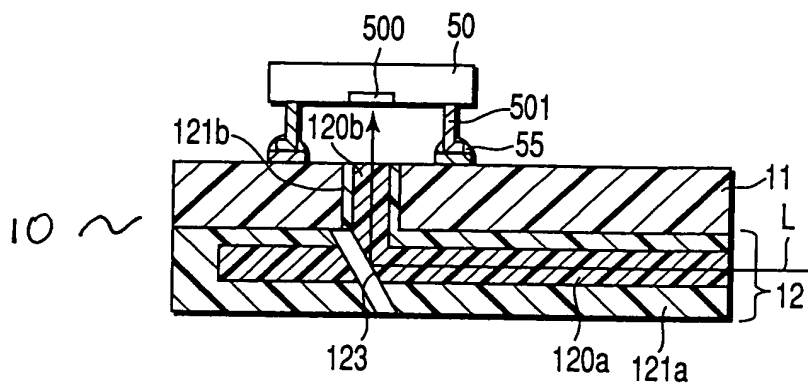


FIG. 13